

Listing of Claims:

1. (Currently Amended) An image reading apparatus
comprising:

a detecting surface adapted to have a detecting object
placed thereon;

5 a sensor array comprising a plurality of sensors arranged to
read an image pattern of the detecting object placed on the
detecting surface; and

a contact detector which detects whether the detecting
object has been brought into contact with the detecting surface
10 and determines whether the detecting object that has been brought
into contact with the detecting surface is a predetermined
specific detecting object,

wherein the contact detector comprises:

a first detection electrode, which is provided at least
15 on an upper portion of the sensor array, and which comprises the
detecting surface;

a second detection electrode which comprises a
conductive case member that is formed of a conductive material
and surrounds the sensor array, the second detection electrode
20 being electrically insulated and spaced apart from the first
detection electrode;

a counter electrode which is provided at a lower side of the first detection electrode that is on an opposite side of the first detection electrode from the detecting surface, the counter electrode being opposite to the lower side of the first detection electrode with an interlayer insulating film provided therebetween;

a signal voltage applying circuit which applies a signal voltage having a first signal waveform that varies periodically to the counter electrode to excite a second signal waveform to the first detection electrode through the interlayer insulating film; and

~~a contact detector which comprises a detecting circuit connected to for detecting a third signal waveform excited to the~~
second detection electrode;

wherein the detecting circuit (i) detects, upon contact of the detecting object with both the first detection electrode and the second detection electrode, the contact detector determining whether the detecting object brought into contact with the detecting surface is a specific detecting object based on a voltage level of the a third signal waveform excited to the second detection electrode, (ii) compares the third signal waveform with a threshold voltage that is preset based on a capacitance component and a resistance component of the specific detecting object, and (iii) detects whether the detecting object

has been brought into contact with the detecting surface and determines whether the detecting object is the specific detecting object when the threshold voltage is included within a range of a voltage amplitude of the third signal waveform; and

50 wherein the threshold voltage is set either to a voltage that is higher than an upper limit value of the third signal waveform excited to the second detection electrode in a state in which the detecting object does not come into contact with the detecting surface, or to a voltage that is lower than a lower
55 limit value of the third signal waveform excited to the second detection electrode in a state in which the detecting object does not come into contact with the detecting surface.

2. (Previously Presented) The image reading apparatus according to claim 1, further comprising a drive controller which supplies a predetermined drive control signal to each sensor of the sensor array to perform an image reading operation of the image pattern of the detecting object placed on the detecting surface.

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3. (Previously Presented) The image reading apparatus according to claim 2, wherein the drive controller controls the image reading operation based on a result of the determination by

the contact detector of whether the detecting object is the
5 specific detecting object.

4. (Previously Presented) The image reading apparatus according to claim 1, wherein each sensor of the sensor array comprises a photosensor, and the first detection electrode and interlayer insulating film transmit light.

5. (Previously Presented) The image reading apparatus according to claim 4, wherein the first detection electrode comprises a transparent conductive film formed on the upper portion of the sensor array with the interlayer insulting film
5 provided between the upper portion of the sensor array and the transparent conductive film, and the photosensors receive light through the first detection electrode and the interlayer insulating film.

6. (Previously Presented) The image reading apparatus according to claim 5, wherein the transparent conductive film comprises indium-tin oxide.

7. (Previously Presented) The image reading apparatus according to claim 1, wherein the first detection electrode

comprises a conductive film formed on the upper portion of the sensor array.

Claim 8 (Canceled).

9. (Previously Presented) The image reading apparatus according to claim 1, wherein the specific detecting object is a part of a human user, and the image pattern read by the sensor array is an image pattern specific to the human user.

10. (Previously Presented) The image reading apparatus according to claim 1, wherein the first detection electrode and the second detection electrode are arranged such that the detecting object is laid across the first detection electrode and the second detection electrode to be brought into contact therewith.

11. (Previously Presented) The image reading apparatus according to claim 1, further comprising an amplitude limiting circuit which defines upper and lower limit voltage values of the second signal waveform excited to the first detection electrode.

12. (Previously Presented) The image reading apparatus according to claim 11, wherein the amplitude limiting circuit

comprises an anti-parallel diode circuit provided between the first detection electrode and a ground potential, and the amplitude limiting circuit defines the upper and lower limit voltage values of the second signal waveform excited to the first detection electrode based on forward voltages of respective diodes that form the anti-parallel diode circuit.

13. (Previously Presented) The image reading apparatus according to claim 1, wherein the signal voltage applying circuit applies, to the counter electrode, a signal having a predetermined voltage amplitude and two periodical voltage levels.

14. (Currently Amended) The image reading apparatus according to claim 1, wherein the contact detector determines whether the detecting object is the specific detecting object based on a value of ~~[[a]]~~ the voltage amplitude and a value of a central voltage of the voltage amplitude of the third signal waveform excited to the second detection electrode.

Claims 15 and 16 (Canceled).

17. (Currently Amended) The image reading apparatus according to claim ~~15~~ 1, wherein the threshold voltage is set to

a voltage that is higher than ~~an~~ the upper limit value of the
5 third signal waveform excited to the second detection electrode
in ~~[[a]]~~ the state in which ~~at least~~ the detecting object does
not come into contact with the detecting surface.

18. (Currently Amended) The image reading apparatus
according to claim ~~15~~ 1, wherein the threshold voltage is set to
a voltage that is lower than ~~[[a]]~~ the lower limit value of the
third signal waveform excited to the second detection electrode
5 in ~~[[a]]~~ the state in which at least the detecting object does
not come into contact with the detecting surface.

19. (Currently Amended) The image reading apparatus
according to claim ~~15~~ 1, wherein the ~~contact detector~~ detecting
circuit comprises a threshold voltage setting circuit that sets
the threshold voltage, and a comparing circuit that compares the
5 threshold voltage and the third signal waveform.

20. (Currently Amended) The image reading apparatus
according to claim 19, wherein the ~~contact detector~~ detecting
circuit determines whether the threshold voltage is included in
~~[[a]]~~ the range of ~~[[a]]~~ the voltage amplitude of the third
5 signal waveform based on a result of the comparison by the
comparing circuit, and outputs a contact detection signal

indicating that the detecting object is the specific detecting
object when it is determined that the threshold voltage is
included in the range of the voltage amplitude of the third
10 signal waveform.

21. (Currently Amended) The image reading apparatus
according to claim 19, wherein the third signal waveform is a
waveform that varies periodically, and the contact detector
comprises ~~means for detecting whether the third signal waveform~~
5 ~~has passed the threshold voltage, and a count~~ a contact
determining circuit which counts a number of times that the third
signal waveform has passed the threshold voltage based on a
signal from the detecting circuit, and ~~the contact detector which~~
outputs a contact detection signal indicating that the detecting
10 object is the specific detecting object when a number of times in
a row that the third signal waveform has passed the threshold
voltage ~~counted by the count circuit~~ exceeds a preset number of
times.

22. (Previously Presented) The image reading apparatus
according to claim 1, wherein the sensors comprise photosensors,
each of which includes a source electrode and a drain electrode
that are formed to sandwich a channel area formed of a
5 semiconductor layer, and a first gate electrode and a second gate

electrode that are formed at least on upper and lower portions of the channel area with respective gate insulating films provided between the gate electrodes and the channel area, and wherein a reset pulse is applied to the first gate electrode to initialize the sensor and a precharge pulse is applied to the drain electrode, thereafter a read pulse is applied to the second gate such that an electrical charge corresponding to an amount of irradiated light is stored in the channel area for a charge storing time, which is from an end of initialization to application of the read pulse, and a voltage corresponding to the amount of the stored charge is output as an output voltage to the channel area, and the image pattern of the detecting object placed on the detecting surface is read based on a difference between a signal voltage according to the precharge pulse and the output voltage.

23. (Previously Presented) The image reading apparatus according to claim 22, wherein the sensors are formed on an insulating substrate that transmits light, a protection insulating film is formed on a side of the sensors opposite to the insulating substrate, and the interlayer insulating film includes the protection insulating film and the gate insulating films.

24. (Previously Presented) The image reading apparatus according to claim 23, wherein a transparent conductive film is formed on the protection insulating film, and the first detection electrode comprises the transparent conductive film.

25. (Previously Presented) The image reading apparatus according to claim 22, wherein the counter electrode comprises the drain electrodes, and the first signal voltage applied to the counter electrode by the signal voltage applying circuit is a
5 pulse voltage applied to the drain electrodes.

26. (Original) The image reading apparatus according to claim 25, wherein the pulse voltage is the precharge pulse.

27. (Previously Presented) The image reading apparatus according to claim 22, wherein the sensor array includes a plurality of drain lines connected to the drain electrodes of the photosensors, the counter electrode comprises the drain
5 electrodes and the drain lines, and the first signal voltage applied to the counter electrode by the signal voltage applying circuit is a pulse voltage applied to the drain lines.

28. (Original) The image reading apparatus according to claim 27, wherein the pulse voltage is the precharge pulse.

29. (Previously Presented) The image reading apparatus according to claim 1, wherein a time constant, which is defined by a resistance component between the detecting surface and a ground potential and a capacitance component added to the
5 detecting surface, is set to a value in a range of 0.2 to 0.3 μ sec.

30. (Original) The image reading apparatus according to claim 29, wherein the resistance component includes electrical resistance of the first detection electrode.

31. (Previously Presented) The image reading apparatus according to claim 29, wherein the capacitance component includes electrostatic capacitance between the first detection electrode and the counter electrode and between the first detection
5 electrode and the sensors.

32. (Previously Presented) The image reading apparatus according to claim 29, wherein the time constant is set to a value in a range of 0.2 to 0.25 μ sec.

33. (Previously Presented) The image reading apparatus according to claim 29, wherein the resistance component has a sheet resistance having a value of 30 Ω .

34. (Previously Presented) The image reading apparatus according to claim 29, wherein the capacitance component has a capacitance having a value set to approximately 7 to 10 nF.

35. (Previously Presented) The image reading apparatus according to claim 29, wherein each sensor of the sensor array comprises a photosensor having a light receiving surface, the first detection electrode has an area larger than a light
5 receiving area of the sensor array, and the first detection electrode comprises a transparent electrode film formed on an upper portion of the light receiving area of the sensor array with the interlayer insulating film provided between the upper portion of the light receiving area and the transparent electrode
10 film; and

wherein the photosensors receive light in the light receiving area through the first detection electrode and the interlayer insulting film.

36. (Previously Presented) The image reading apparatus according to claim 35, wherein a conductive member having a resistance value that is lower than a resistance value of the transparent conductive film is provided to be electrically
5 connected to an area besides an area corresponding to at least a light receiving area of the transparent conductive film.

37. (Original) The image reading apparatus according to claim 36, wherein the resistance component includes electrical resistance formed by the transparent conductive film and the conductive member.

38. (Previously Presented) The image reading apparatus according to claim 36, wherein the conductive member comprises one of chromium, aluminum, an alloy material containing chromium, and an alloy material containing aluminum.

39. (Currently Amended) A driving method for driving an image reading apparatus including a sensor array having a detecting surface on which a detecting object is placed and a drive controller which reads an image pattern of the detecting object placed on the detecting surface, the method comprising:

applying a signal voltage having a first signal waveform that varies periodically to a counter electrode which is provided on an upper portion of the sensor array such that the counter electrode is provided at a lower side of a first detection electrode which comprises the detection surface at an upper side thereof with an interlayer insulating film provided between the counter electrode and the first detection electrode, to excite a second signal waveform to the first detection electrode;

detecting a third signal waveform, which is excited to a
15 second detection electrode upon contact of the detecting object
with both the first detection electrode and the second detection
electrode, the second ~~signal~~ detection electrode comprising a
conductive case member that surrounds the sensor array and being
electrically insulated and spaced apart from the first detection
20 electrode, and the detecting being performed by a detecting
circuit connected to the second detection electrode;

detecting whether the detecting object has been brought into
contact with the detecting surface and determining whether the
detecting object that has been brought into contact with the
25 detecting surface is a specific detecting object based on a
voltage level value of the ~~detected~~ third signal waveform
detected by the detecting circuit; and

starting reading of the image pattern by the drive
controller when it is determined that the detecting object has
30 been brought into contact with the detecting surface and that the
detecting object is the specific detecting object;

wherein detecting whether the detecting object has been
brought into contact with the detecting surface and determining
whether the detecting object is the specific detecting object
35 comprises:

comparing the third signal waveform with a threshold
voltage that is preset based on a capacitance component and a

resistance component of the specific detecting object, and
determining whether the threshold voltage is included within a
40 range of a voltage amplitude of the third signal waveform; and
detecting whether the detecting object has been brought
into contact with the detecting surface and determining whether
the detecting object is the specific detecting object when it is
determined that the threshold voltage is included within the
45 range of the voltage amplitude of the third signal waveform, and
wherein the threshold voltage is set either to a voltage
that is higher than an upper limit value of the third signal
waveform excited to the second detection electrode in a state in
which the detecting object does not come into contact with the
50 detecting surface, or to a voltage that is lower than a lower
limit value of the third signal waveform excited to the second
detection electrode in a state in which the detecting object does
not come into contact with the detecting surface.

Claims 40 and 41 (Canceled).

42. (Currently Amended) The driving method for the image
reading apparatus according to claim ~~40~~ 39, wherein comparing the
threshold voltage with the third signal waveform comprises
detecting whether the third signal waveform has passed the
5 threshold voltage, and determining that the detecting object is

the specific detecting object when a number of times in a row that the third signal waveform has passed the threshold voltage exceeds a preset number of times.

43. (Currently Amended) The driving method for the image reading apparatus according to claim ~~40~~ 39, wherein the threshold voltage is set to a voltage that is higher than ~~an~~ the upper limit value of the third signal waveform excited to the second detection electrode in ~~[[a]]~~ the state in which ~~at least~~ the detecting object does not come into contact with the detecting surface.

44. (Currently Amended) The driving method for the image reading apparatus according to claim ~~40~~ 39, wherein the threshold voltage is set to a voltage that is lower than ~~[[a]]~~ the lower limit value of the third signal waveform excited to the second detection electrode in ~~[[a]]~~ the state in which at least the detecting object does not come into contact with the detecting surface.